# Hardware – introduction to input, output and storage devices

Purpose of a computer system is to process data. To be able to process data, the computer system must be given the data through input devices. Once the data is processed it might need to produce an output to an output device(s). Some processing results may need to be stored or some reference may need to be made to previously stored data(storage devices).

Block Diagram of a computer system
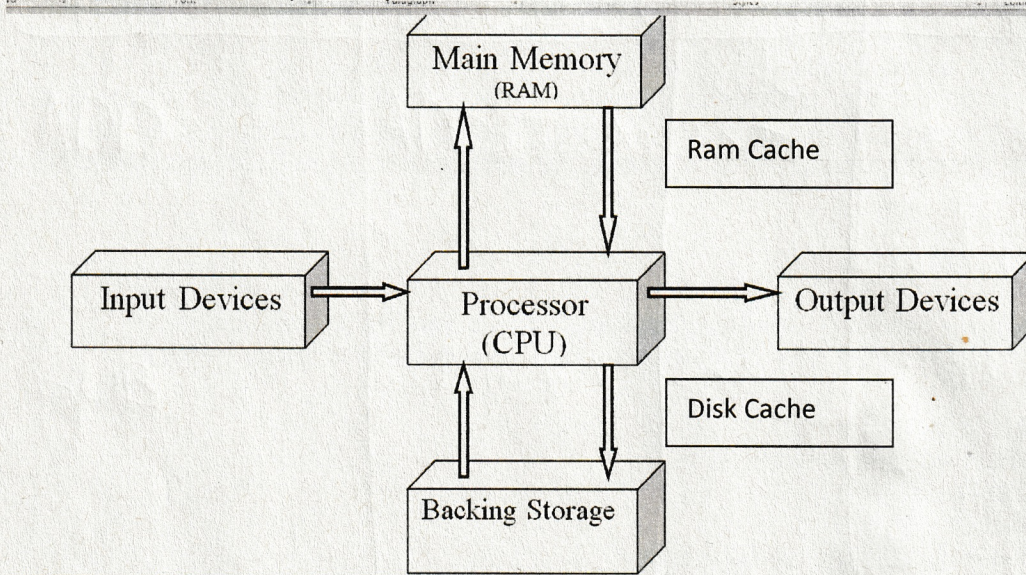
Processor:

ALU - performs the calculations on the data (the arithmetic unit) and comparisons (the logic unit).

Control Unit - controls (coordinates) all of the operations inside the computer, by sending control signals telling devices to be ready for read/write or getting the devices to read/write or delete data in the right order using the fetch-decode-execute cycle.

Register – stores a single item of data. Registers to know include: Accumulator, Program Counter, Current Instruction Register, Memory Buffer Register, Memory Address Register

Accumulator – holds intermediate results of calculations

Program Counter – contains the address of the next instruction to be fetched from memory. Also called Sequence Control Register.

Current Instruction Register – holds the instruction that has just been fetched from memory via the MDR

Memory Data Register – is a location in the processor where data or instructions are held prior to being written to memory or as they are received from memory.

Memory Address Register – Contains the address in memory where data is about to be written to, or from which data is about to be fetched. Source or Destination of the data.

Memory:

Data and programs are stored in memory. Memory consists of many storage locations, each of which holds one byte of data. Each location can be defined by a number called its address.

RAM - is the type of memory used for **temporarily** storing programs and data.
- **Volatile** – the data is lost when the power switched off

ROM - is used for storing **permanent** data.
- **Non-volatile** – the data is never lost

- **Uses:** Stores bootstrapping program\ embedded systems

RAM Cache – used to **temporarily** store **frequently** used data
- Faster than RAM\ Speeds up Computer

Buses:
1. **Data Bus** – **carries** data from the processor to different parts of the computer.
2. **Address Bus** – **carries** the memory location of data to be stored in RAM.
3. **Control Bus** – **carries** control signals from the control unit to other parts of the computer.

Bit: a single binary digit. **0 or 1**
Byte: a group of 8 binary digits, e.g. 00110010.
Word: is the number of bits that the CPU can handle at a time; the amount of data that can be transferred between the cpu and RAM in one go. Varies with the computer as the wordlength of a 16 bit computer is 16 whereas the wordlength of a 32 bit machine is 32 bits.

Secondary Storage:

Disk Cache - stores data when it is input from a disc for faster access.
Web Cache – stored data of frequently used webpages for faster access.

- **Magnetic tape**
  - **Access:** Sequential\ Slow
  - **Storage:** Very large
  - **Cost:** Very cheap
  - **Portability:** Good\ Durable
  - **Use:** Large back ups
- **Magnetic disk**
  - **Access:** Direct\ Fast
  - **Storage:** Large
  - **Cost:** Reasonably cheap
  - **Portability:** only as an external hard drive
  - **Use:** Computer hard drive
- **Optical disk** (CD-ROM ; DVD)
  - **Access:** Direct\ Fast
  - **Storage:** Small to medium
  - **Cost:** Cheap
  - **Portability:** very portable but some durability issues
  - **Use:** Software install disks
- **Flash memory**
  - **Access:** Direct\ Very fast
  - **Storage:** Small to medium
  - **Cost:** Quite expensive
  - **Portability:** very portable due to size
  - **Use:** portable data transfer

Analogue\ Digital:

1. **Difference** - analogue is a continuous varying signal and digital consists of discrete bit patterns
2. **Computers are digital and analogue signals such as temperature\ voice need converting to digital for processing**

Hand Shaking - A signal sent from one device to another. Acknowledges devices are ready to communicate